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THE RELATIONSHIP BETWEEN CHUNKING AND VERBAL MEDIATION VISUAL MEMORY ABILITIES AND READING ACHIEVEMENT OF GRADE FOUR CHILDREN

by

© JEROME MICHAEL JESSEAU

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE

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FACULTY OF GRADUATE STUDIES AND RESEARCH

The undersigned hereby certify that they have read, and recommend to the Faculty of Graduate Studies and Research, for acceptance, a thesis entitled THE RELATIONSHIP BETWEEN CHUNKING AND VERBAL MEDIATION VISUAL MEMORY ABILITIES AND READING ACHIEVEMENT OF GRADE FOUR CHILDREN submitted by Jerome Michael Jesseau in partial fulfillment of the requirements of the degree of Master of Education.

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ABSTRACT

This study was designed to investigate two processes involved in short term memory for visual input. These two processes are chunking and verbal mediation abilities. The study was undertaken in an attempt to determine the relationship between these abilities and reading achievement. Related variables were chronological age and I.Q.

The sample consisted of 96 grade four students from the Edmonton Catholic System, 48 high reading achievers and 48 low reading achievers. The subjects were chosen on the basis of scores made on the Gates-MacGinitie Reading Test and on the Lorge-Thorndike Intelligence Test, both of which had been administered by personnel in the Edmonton Catholic System. The children were screened for auditory acuity with the Maico Audiometer.

The Chunking Task and the Verbal Mediation Tasks were specially constructed for this study to measure the chunking and verbal mediation abilities of the children.

Two-way analysis of variance and correlations were used in the statistical analysis of the resulting data.

Findings indicated that there were significant differences between the scores obtained by the high and low

reading achievers on all tasks. Within the Chunking Task there was no significant difference between the various combinations of the Ordinary, Syllabic, and Letter Formats for either group of readers; but that there were significant differences between each of these formats and the Extraordinary Format for both groups. Within the Verbal Mediation Task I there were significant differences between the scores on the Pronounceable and the Non-pronounceable Items for both the high and low reading achievers. For the Verbal Mediation Task II the high and low reading achievers did not differ significantly between the scores on the Visual and the Visual-auditory Items.

These findings seem to indicate that even though the high reading achievers scored significantly higher than the low reading achievers on all tasks, they did not basically differ in the nature of the tasks they completed. That is, the high reading achievers and low reading achievers tended to process information similarly, but at different levels.

There were few significant correlations with chronological age, I.Q., or reading scores.

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CHAPTER ONE

INTRODUCTION AND PROBLEM

The term visual memory seems to be a misleading one. If a person sees a word, does he memorize a visual image of that word, or does he attach a verbal label to it, or does he have some more complex image of it? To remember the word does he group the letters in any particular way? Between the input of visual stimulus and a physical output, memory for visual images appears to involve several factors such as recoding, verbalization, and storage. It is not possible to observe these processes directly. From the physical output, or the product, the investigator must try to determine the processes that operated. Several authors (Goins, 1958; Froehlich, 1970; Woychuk, 1973) looked at visual memory as product rather than as process. They considered visual memory as the recall of visual images. This writer would like to go beyond that level and try to make stronger inferences about what happens between input and output.

Short term memory (storage and retrieval of information immediately after presentation) has been described in various ways. Two factors identified by the literature which may be important in understanding short term memory are chunking and verbal mediation. According to Smith (1971) the form of the information determines how much gets into the short term memory. Miller (1956) stated that recoding is the

process by which it is possible to store longer and longer units or chunks, and consequently to store more information. If there are many small units, a greater strain is placed on the short term memory.

Several authors (Sperling,1967; Norman,1969) have stressed the importance of rehearsal in which the subject verbalizes what he has seen in order to remember it. It has long been believed that subjects verbalize what they read. Huey (1908) believed that the sound of a word was dimly suggested immediately accompanying the word's visual appearance.

I. PURPOSE

The purpose of this study was to investigate the chunking and verbal mediation abilities of selected grade four children by having them remember words arranged in various chunking formats and at different levels of labelling facility.

II. DEFINITION OF TERMS

Short term memory (STM). The ability of an individual to recall immediately a series of stimuli which have been presented to him in a particular sequence.

Short term memory for visual input. A specific example

of the above definition in which the stimuli are printed letters.

Verbal mediation. The ability to attach verbal labels to printed letters.

Chunking. Organization of the letters into various unit sizes. A letter itself may be a unit and, therefore, a chunk.

High reading achiever (HRA). A subject who scored above the group mean on the Gates-MacGinitie Reading Test, Comprehension Grade Score.

Low reading achiever (LRA). A subject who scored below the group mean on the Gates-MacGinitie Reading Test, Comprehension Grade Score.

Ordinary Format. Presentation of words in which the spacing between the letters is in proportion to that which would occur in regular typing.

Syllabic Format. Presentation of words in which the spacing between syllables is five times that which would occur in regular typing.

Letter Format. Presentation of words in which the spacing between each letter is five times that which would occur in regular typing.

Extraordinary Format. Presentation of words in which

the letters are grouped in such a manner that they do not correspond to syllabic divisions of the word. Spaces between these units is five times that which would occur in regular typing.

Pronounceable Items. Groups of letters which resemble allowable sequences of letters in the English language and to which a sound association can be easily attached.

Non-pronounceable Items. Groups of letters which do not resemble allowable sequences of letters in the English language and to which a sound association can not be easily attached.

Visual Presentation. The words are presented on cards and shown to the subjects for the number of seconds which correspond to the number of letters in the word.

Visual-auditory Presentation. This is similar to the Visual Presentation except that the word is spoken by the examiner as the word is being shown.

Intelligence Quotient (IQ). A measure of intelligence as shown by a score on the Non-verbal portion of the Lorge-Thorndike Intelligence Test.

III. HYPOTHESES

The following hypotheses have been formulated and are tested in this study. The level of significance for

rejecting the null hypotheses is .05.

Research Hypothesis 1

The HRA's will score higher than the LRA's on each of the formats (Ordinary, Syllabic, Letter, and Extraordinary).

Null Hypothesis

There is no significant difference in the scores obtained by the HRA's and the LRA's on the Ordinary, Syllabic, Letter, and Extraordinary Formats.

Research Hypothesis 2

HRA's will score highest to lowest in the following sequence:

(a) Ordinary and Syllabic Formats (Similar).

(b) Letter Format.

(c) Extraordinary Format.

Null Hypothesis

There is no significant difference between the scores obtained by the HRA's on the various combinations of Ordinary Format, Syllabic Format, Letter Format, and Extraordinary Format.

Research Hypothesis 3

LRA's will score highest to lowest in the following sequence:

(a) Syllabic Format.

(b) Extraordinary Format.

(c) Ordinary and Letter Formats (Similar).

Null Hypothesis

There is no significant difference between the scores obtained by the LRA's on the various combinations of Ordinary Format, Syllabic Format, Letter Format, and Extraordinary Format.

Research Hypothesis 4

HRA's will score higher than the LRA's on the Pronounceable Items, but LRA's will score higher than the HRA's on the Non-pronounceable Items.

Null Hypothesis

There is no significant difference between the scores made by the HRA's and the LRA's on the Pronounceable Items and on the Non-pronounceable Items.

Research Hypothesis 5

HRA's will score higher on Pronounceable Items than on the Non-pronounceable Items.

Null Hypothesis

There is no significant difference between the scores obtained by the HRA's on the Pronounceable and Non-pronounceable Items.

Research Hypothesis 6

LRA's will not differ significantly on the Pronounceable Items and the Non-pronounceable Items.

Null Hypothesis

There is no significant difference between the scores obtained by the LRA's on the Pronounceable and Non-pronounceable Items.

Research Hypothesis 7

HRA's will not score differently on the Visual Items and on the Visual-auditory Items.

Null Hypothesis

There is no significant difference in the scores obtained by the HRA's on the Visual and Visual-auditory Items.

Research Hypothesis 8

LRA's will score higher on Visual-auditory Items than on the Visual Items.

Null Hypothesis

There is no significant difference between the scores obtained by the LRA's on the Visual and Visual-auditory Items.

IV. ASSUMPTIONS

It is assumed that the method the subjects use in trying to remember the words of the tasks is the same as that used in remembering words for reading purposes.

It is assumed that the reading levels of the subjects reflect the levels of grade four children within the Edmonton Catholic Schools, and are not biased by any one school in the study.

It is assumed that chunking and verbal mediation abilities can be measured and that the tasks chosen do so adequately.

V. LIMITATIONS

The following factors are recognized as limiting the generalizations made from the data collected in this study.

(1) Chunking and Verbal Mediation are interacting variables and it is not possible to completely separate one from the other. However, it is possible to determine by analysis the extent to which verbal mediation may effect the Chunking Task results.

(2) Motor skills are involved. However, only letters have to be drawn, the quality of the letters is not important, and subjects are at the grade four level.

(3) Because of difficulties in obtaining sufficient subjects, six students were chosen whose I.Q. scores were not within one standard deviation of the mean. These six students had I.Q. scores of 117-118, four of which were HRA's, two were LRA's.

VI. SIGNIFICANCE OF THE STUDY

There are many factors involved in the processes of learning to read. If through research more can be found out about how the reader organizes visual input, then modifications can be made in reading programs and methodology. These would be intended to aid those who are not processing information in visual letter form in as

efficient a manner as possible. If poor readers can be taught to chunk and mediate verbally more efficiently, then this would be one step in their reading improvement.

VII. OVERVIEW OF THE STUDY

In Chapter Two the writer will review pertinent literature which led him to carry out this study and which forms a framework for the study.

Chapter Three will outline the research design, the sample, the construction of test instruments, pilot study, collection, scoring, and treatment of the data.

Chapter Four will deal with the analysis and interpretation of the data.

In Chapter Five the summary, conclusions, implications, and suggestions for further research will be presented.

CHAPTER TWO

BACKGROUND OF THE STUDY AND REVIEW OF RELATED LITERATURE

The purpose of this chapter is to provide a background for this investigation into some aspects of visual short term memory in high and low reading achievers. The chapter is designed to review pertinent literature concerning visual short term memory and its role in reading. Studies discussed will focus on descriptions and models of memory, its organization, and related variables.

The writer has attempted to determine the role of visual short term memory in reading and to learn something, not only of the product but, of the processes involved in short term memory.

I. DEFINITIONS AND DESCRIPTIONS OF MEMORY

The processes of memory consist of acquisition, retention and retrieval of information, or more simply, the capacity to store information subject to recall.

Blankenship (1938) defined memory from two viewpoints, functionally and structurally. From the functional aspect he referred to memory span as the ability of an individual to

reproduce immediately a series of stimuli in original order, after one presentation. He wanted to see external evidence. From a structural viewpoint he was more interested in internal processes involved. Apart from possessing intact sense organs and a nervous system, it was necessary to possess attentive perceptual and motor abilities to be able to reproduce the stimuli observed.

According to Howe (1970) memory shares many functions with perception, learning and thinking. Memory requires storage of information, as learning and thinking and there is some overlapping in their mechanism. Howe distinguished between memory and learning by indicating that learning occurs when new meaning is acquired and there is a major reorganization of cognitive structures whereas memory is where emphasis is on retention of information without any radical cognitive reorganization. Posner (1967) equated the rehearsal aspect of memory with learning. By practicing or rehearsing one is learning and memorizing.

Kinds of Memory

Memory is not just passive repository, information is actively stored and must be retrieved. A reader extracting information from the page must make an active contribution and add to the visual information on the page, his knowledge of language and the world (Smith,1971). Reading would be impossible otherwise.

Smith (1971) described three kinds of memory, all of which play a part in reading. First, sensory store, which briefly retains the perceptual raw material while information processing begins. There seems to be total recall from sensory store since it is present for only a very short time. There is rapid decay in the sensory store, for new information is entering it constantly. Second, short term memory, which takes items from the sensory store. It has much less capacity than the sensory store. Information is lost from here unless it is constantly recirculated. There is no time limit on short term memory as long as material is continually rehearsed, but because new information is constantly entering, its duration is very short. Third, there is long term memory, for which there are no limits to the amount of information stored, but it takes time for material to enter and sometimes retrieval procedures are inadequate and one seems to forget what has been stored.

Primary and secondary memory were two types of memory suggested by Waugh and Norman (1965). Primary memory consists of events which have not left the consciousness and are in the psychological present; whereas secondary memory consists of events recalled from beyond consciousness, in the psychological past. This seems to be somewhat the same as the continuum implied by Smith's three kinds but are not quite as detailed.

Are primary memory and secondary memory separate entities or two aspects of the same continuum? Melton (1963) believed that they were on a continuum and that they were both mediated by the same storage mechanism. The neural connections have to be made to insure that the information reaches long term memory and the recirculation in the short term memory helps accomplish this. Smith's description of the three kinds of memory seems most acceptable to this writer, and it is the second kind, short term memory which is the subject of this study.

Capacity and Organization

The capacity of short term memory seems to be sharply limited in the amount of information it can hold at one time. Miller (1956) referred to this as channel capacity. On the basis of his research and observation he determined that the span of immediate memory was seven items plus or minus two. Waugh and Norman (1965) also subscribed to this idea, but didn't specifically give the same number as Miller. Many other authors (Gibson, 1967; Tulving, 1968; Norman, 1969; Howe, 1970; Smith, 1971) have since referred to Miller in discussion on the limited capacity of short term memory, and also to the need for organization in short term memory to increase the total amount of information that can be processed. Thus we get the word "chunks" which contain "bits" of information. The limit of seven which Miller

refers to is called the span of absolute judgement, however, memory capacity is not completely bound to this finite number. Simon (1974) felt that seven was too high, and decided that the limit was five chunks.

There are various techniques of organization or chunking material in such a way as to improve the actual amount of material remembered. By grouping or recoding one can increase the size of the chunks, and the larger the chunks, the more information which can be memorized. Miller stated that the customary kind of recoding which individuals do is to translate into verbal code. Smith (1971) also used this idea of recoding when referring to the form of the information determining how much got into short term memory. Letters to words, words to sentences, this is the chunking the reader does in reading a sentence. The perceived words must be held in the short term memory long enough for the reader to bring syntactic and semantic elements from his long term memory until he can understand the sentence. Then the processed elements in short term memory are disposed of or put in long term memory (Smith,1971). Among organism variables that limit memory span are included the amount of material the subject is able to bring to the process of immediate memory, the size of the capacity for storing immediate memory traces, the rate of decay, and the rate of reporting (Allwitt,1963).

Models

The "goal is to describe human memory as completely as possible, so that one can explain what happens when someone perceives information and later shows that he has retained it." (Howe,1970,p.6)

Several authors (Waugh and Norman, 1965; Sperling, 1967; Norman, 1969) made use of diagrammatic flow charts to show their concept of memory. The model of Waugh and Norman (1965) was very simple, but adequate to show the difference between primary memory and secondary memory. This model is shown in Figure 1 below.

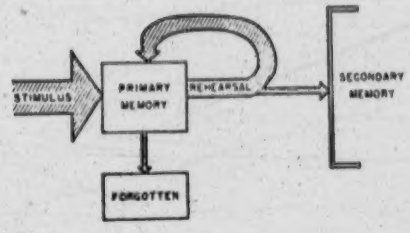

FIGURE 1

The capacity of this system is obviously limited; some

information is lost, or rehearsed, or it passes into secondary memory. However, it is inadequate if one wants to show in more detail the processes involved in memory. This has been a major difficulty in studying memory, but according to Sperling (1967) the only method is to present subjects with a number of memory tasks and record their actions. Sperling devised several models to show his understanding of the short term visual memory process. The same models were used by Norman (1969) in his text.

FIGURE 2

MODEL 1 VIS - visual information storage

This model allows for no rehearsal. The input goes directly from visual information storage to motor translator. Sperling rejected this model because as the

subject is to write the letters his visual image will have disappeared. Following rejection of this model Sperling suggested another model.

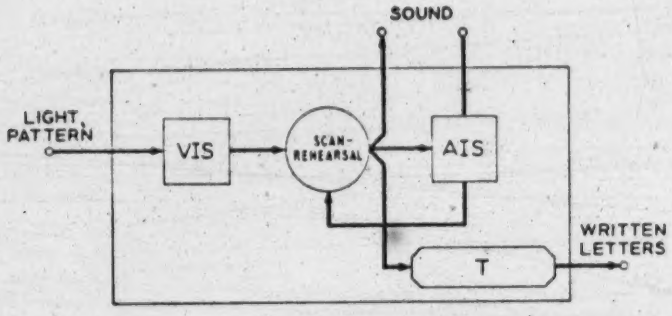

FIGURE 3

MODEL 2 AIS - auditory information storage

T - translator

Sometimes a subject mumbles and rehearses, which implies other mechanisms of memory. The subject says the letter, hears himself, and remembers an auditory image which he rehearses either aloud or subvocally. Sperling infers the existence of an auditory memory in visual tasks because of mistakes made with letters that sound alike. Conrad (1964) stated that visually presented material yields acoustically related errors. This indicates that the majority of subjects

verbalize stimuli rather than attempting to store it in a visual form. Even though this is an attractive model Sperling rejects it because the formation of the auditory image and rehearsal would be too slow for all the new visual images entering. Thus he proposed his third and final model.

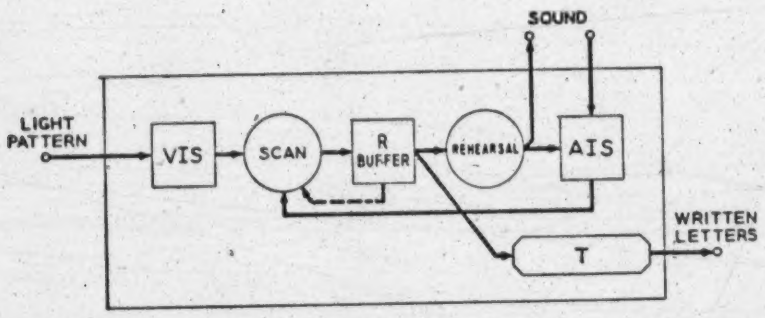

FIGURE 4

MODEL 3 R Buffer - recognition buffer memory

The major advance with this model is the introduction of the recognition scanner which translates the visual images into programs of motor instructions and , therefore, programs for rehearsing several letters can be set up simultaneously. Setting up of programs is faster than executing programs. From such a model as this, it appears that visual memory is much more complex than it first

appeared. It seems as though auditory memory plays part, even when input is visual. Howe (1970) wondered about the same thing, whether there was more than one way of storing information. If a word is stored, exactly what is stored? A picture of it? The sound of it? Or some image more complex? A person perceives events in terms of his personal experiences and this writer believes that the memorial images formed are complex representations of the word perceived. There is some visual image of the word and some auditory image, and also further images which are colored by a personal frame of reference.

Role of Rehearsal

Most of the models of short term memory seem to make much of the role of rehearsal in visual memory. It appears to be the link between visual image and an auditory image. Huey (1908) believed that the sound of a word seems to be dimly suggested immediately accompaning or following the word's visual appearance. And Norman (1969) stated that "the vocal aspect of rehearsal implied that material is remembered in auditory form, even when it was originally presented in visual form" (P.86). Thus rehearsal may be equated with repeating things to oneself, in some tasks by overt speech, in some by concentration (Posner,1967). The short term memory can retain material for an indefinite period of time provided there is an opportunity for

rehearsal. Conrad (1964) emphasized the importance of verbal encoding if visual encoding is to survive in the presence of continual input. Waugh and Norman (1965) believed that it is very difficult not to rehearse material one is trying to memorize. And even if one is given a distracting task it still seems unlikely that all rehearsal will be prevented. When rehearsal does take place it gives the information more chances to be circulated and scanned and thus has a better chance of entering long term memory.

Role of Perception and Motor Skills

It is extremely difficult to give memory tests which test memory alone. Most memory tasks are contaminated by perception and motor skills. A subject can remember only what he has perceived. Information that has entered the sensory store may be lost before it can be transferred to short term memory. Smith (1971) believed that the duration of the sensory storage was less than one second. There is always new information entering which may interfere with the processing of vital information. From Sperling's (1963) description of visual information storage (VIS), it would appear to be the same as the sensory store.

Motor skills also have implications for what has been remembered. The subject must respond in some manner to show that he has remembered. It would appear that this would be a problem only with the very young who had not learned to make

adequate responses, or with those afflicted with some physical or mental disorder. Several authors expressed concern about the problem of perception and motor difficulties in memory tasks. (Miller,1956; Goins,1958; Weiner, Wepman, and Morency,1965; Froehlich,1970)

A problem with this is that tests of visual memory may actually be testing something other than visual memory. To eliminate motor skills from visual memory tests, Carroll (1972) depended on recognition, rather than reproduction for answers. He stated that researchers should try to look at processes rather than output. He couldn't eliminate perception but was able to reduce the motor aspect. He admitted that maybe he wasn't testing visual memory at all. In his research, Silverstein (1962) noted that correlation between reproduction and recognition tasks was not significant, implying that the two types of tasks are measuring something different. Howe (1970) suggested that other factors should be controlled as much as possible. Specifically he suggested to minimize perception, that the researcher present two perceptually equivalent lists and vary the memory requirements. Carroll (1972), Silverstein (1962) and Weiner, Wepman and Morency (1965) noted that the Benton Visual Retention Test, the Memory For Designs test and the Frostig as three tests which measure perceptual and motor skills. Woychuk (1973) used an adapted Benton Visual Retention Test and described among her testing instruments,

that it was a test designed to assess memory, perception and visuomotor functions; yet she used it as though she were only measuring visual memory.

Another aspect of the problem with such tests is that they penalize perceptually immature subjects. Guthrie and Goldberg (1972) felt that alleged inferiority of disabled readers in visual memory was due to deficiency of perception. Treischmann (1968) and Vernon (1957) also found slower perceptual development in children with reading problems. If one is comparing normal and disabled readers on visual memory it seems evident that the disabled readers will score lower on visual memory. Thus when one is testing subjects on visual memory and correlating it with reading achievement one has to be careful about conclusions drawn from data which may be invalid.

So it appears that memory is such a difficult function to isolate. Perception cannot be eliminated totally, but as Howe suggested, maybe it can be reduced by giving perceptually equivalent tasks. The effects of motor skills may also be reduced by using recognition tasks rather than reproduction tasks. No matter what is used one can only hope to come closer to actually measuring visual memory. Also it may not be realistic for educational purposes to try to eliminate entirely the perceptual and motor components of memory since these are automatically involved in many school tasks.

II. VISUAL MEMORY AND READING ACHIEVEMENT

Visual memory seems to be an important component in the reading process. Several researchers have shown visual memory to be associated with reading achievement. However, there seems to be some dispute about the value of such abilities and which stimuli are most appropriate for measurement of visual memory. It has already been noted that different tests measure different abilities. Forms, digits, letters, and words are often used as stimuli by researchers and those who use any one or two of them usually give what he thinks are good reasons why the others shouldn't be used. Many researchers seem to use forms. A justification that Froehlich (1970) gave for the use of forms was that written symbols are meaningless to a beginning reader, and that visual memory for letters and words involves the same ability as for designs. In one aspect of this the writer is not convinced; letters are not just geometric forms. A triangle is a triangle, no matter what form or orientation it has; but a "b" is not always the same letter if it is rotated and/or reversed.

Several studies have shown visual memory to be associated with reading achievement. Rizzo (1939) found low but significant correlations between visual memory span and reading achievement. The high reading achievers scored higher than the low reading achievers on the memory span

tests. Because of the low correlations Rizzo did not feel confident in his measures of memory span as predictors of reading achievement.

Raymond (1952) compared the results of her study with one done by Stauffer and found that the results were able to differentiate between achieving and retarded readers. It was noted, however, that the I.Q.'s were not matched, and that the achieving readers had higher I.Q.'s than the retarded readers. This might invalidate the conclusions she arrived at. In a later study she (1955) found that good readers had a longer memory span. Lyle (1968) compared fifty-four normal and fifty-four retarded readers of average I.Q. on the Memory For Designs test and found that the scores discriminated between the normal and retarded readers.

In a 1970 study by Froehlich, she found a low but positive relationship between visual memory for designs and reading achievement. The major reservation that this writer had with her study was an over simplified view of visual memory. She merely described visual memory as the ability to remember visual images.

Guthrie and Goldman (1972) did a follow-up study of Froehlich's in visual sequential memory for normal and retarded readers. They believed that the alleged inferiority of disabled readers was due to deficiency of perception. They stated that if a person is unable to determine whether

a stimulus is present or absent, he can't very well remember it. They concluded that visual memory abilities correlated with reading achievement. That seems to be an invalid conclusion, since they believed that deficiencies in perception hindered the disabled readers, and thus the relation may have been with perception and memory and not with memory per se.

Noelker and Schumsky (1973) were other authors who also attempted to identify retarded readers by means of visual memory tests. They compared two groups of twenty-four normal and retarded readers on a forms test and found a significant difference between the groups. These researchers attempted to prevent rehearsal by having the subjects count from one for ten seconds.

Woychuk (1973) set out to determine if there was any difference between achieving and non-achieving readers in visual memory tasks. Her measures of visual memory consisted of forms, digits, letters and words. As already mentioned for the forms aspect of the Benton Visual Retention Test, she only used it as a test of visual memory, whereas it is actually a test of memory, perceptual, and motor abilities. Her total results suggested that all of the memory tasks were related to the reading scores. The letter memory test had the highest correlation with reading achievement and thus should be the best predictor of reading achievement. The non-achievers apparently found the forms and digits

easiest. She (Woychuk) thought that the non-achievers may have become too engrossed in perception of the letters and words. However, it is possible that they also could be engrossed in forms and digits.

Not all authors have found relationships between visual memory and reading achievement. Goins (1958) used a memory for forms task and found no significant relationship. Weiner, Wepman and Morency (1965) gave a visual discrimination task as a memory test. There was no significant difference between good and poor readers. However, the discrimination factor here must be considered.

Dornbush and Basow (1970) also found no significant differences in recall between good and poor readers. However, their subjects were having information presented to them in a bisensory manner.

Eagan (1973) tested visual memory span by using letters and compared the span with oral and silent reading comprehension. She found no statistically significant correlations between oral and silent reading comprehension and visual memory span for letters.

Summary

It is apparent that there is little agreement or consensus concerning the importance of visual memory with regard to reading achievement. Also the trend would appear

to indicate a relationship between the product of visual memory and reading achievement. There are many tests of visual memory, however, which are of doubtful use. There are various types of stimuli about which very few agree. Many authors use convenient reasons and excuses to support their findings. Several authors fear the interference of perceptual and motor skills. No one is really sure that tests of visual memory are really measuring visual memory. One author (Rodenborn,1970) questioned the practise of comparing the performances of disabled and normal readers. He believed that most tests of perception, memory or integration require purposeful concentration and depend on the subject's approach to the situation. The child's self-concept, speed of response plus other factors enter the situation. All of this helps insure that the failing child will fail again.

The emphasis of this study is to attempt to learn more about the processes involved in visual short term memory from observations of the product. This writer hopes to make some contribution in this area of study. The actual focus of the study will be to try to learn something of the manner in which pupils group or chunk letters while attempting to memorize words, and the extent to which they attach verbal labels to words for the purpose of remembering them.

CHAPTER THREE

THE EXPERIMENTAL DESIGN

INTRODUCTION

The purpose of this chapter is to describe the experimental design of the study, the sample, the instruments used, their administration, the pilot study, and the treatment of the data.

I. THE DESIGN OF THE STUDY

The main purpose of this study was to measure and investigate the chunking and verbal mediation abilities of a sample of grade four children, and the relationship of these abilities to reading achievement.

The children were chosen on the basis of their comprehension grade score on the Gates-MacGinitie Reading Test, auditory screening, and were of average intelligence.

Each child was required to take the Chunking Task in one format and one of the two Verbal Mediation Tasks. The Chunking Task was divided into four formats: Ordinary Format, Syllabic Format, Letter Format, and Extraordinary Format. Twelve high and twelve low reading achievers (HRA's and LRA's) were randomly assigned to one of the formats. A

two-way analysis of variance was carried out using the two reading groups and the four formats as the factors of the analysis. The following table (TABLE 3.1) shows the design of the Chunking Task.

TABLE 3.1

SUMMARY OF THE DESIGN OF THE CHUNKING TASK

Formats	HRA's	LRA's
Ordinary	12	12
Syllabic	12	12
Letter	12	12
Extraordinary	12	12
	48	48 = 96

Half of the HRA's (N = 24) and half of the LRA's (N = 24) were randomly assigned to each of the two Verbal Mediation Tasks, 48 subjects to each. The Verbal Mediation Task I was divided into two sets of items, Pronounceable Items and Non-pronounceable Items. Twelve HRA's and twelve LRA's were assigned to one set of items. A two-way analysis

of variance was carried out using the two reading groups and the Pronounceable and Non-pronounceable Items as factors. The following table (TABLE 3.2) shows the design of the Verbal Mediation Task I.

TABLE 3.2

SUMMARY OF THE DESIGN OF THE VERBAL MEDIATION TASK I

Items	HRA's	LRA's
Pronounceable	12	12
Non-Pronounceable	12	12
	24	24 = 48

The remaining half of the subjects were assigned to the Verbal Mediation Task II, which included Visual and Visual-auditory Items. Twelve HRA's and twelve LRA's were assigned to one set of Visual or Visual-auditory Items. A two-way analysis of variance was carried out using the two reading groups and the Visual and Visual-auditory Items as factors. The following table (TABLE 3.3) shows the design of the Verbal Mediation Task II.

TABLE 3.3

SUMMARY OF THE DESIGN OF THE VERBAL MEDIATION TASK II

Items	HRA's	LRA's
Visual	12	12
Visual-auditory	12	12
	24	24 = 48

The relationship between chronological age and I.Q. scores (non-verbal) and reading achievement (comprehension grade scores), and the visual memory scores were analyzed by means of Pearson Product Moment correlations.

II. THE SAMPLE

The sample for this study was selected from six grade four classes in two schools assigned to the researcher by the Edmonton Catholic School System. The total enrollment for the population was 168 pupils. The schools were located in north Edmonton. From the above population 96 pupils were chosen on the basis of the following criteria:

(a) Reading Ability

All students had taken the Gates-MacGinitie Reading Test, Survey D, Form 1M, in January 1974, and since local norms had not yet been calculated the researcher calculated the norm for this population. The mean grade level in comprehension was 5.1, and the standard deviation was 1.7. The high reading achievers were selected from above the mean, and the low reading achievers from below the mean.

(b) Intelligence Quotient

It was necessary to limit the sample to students whose reading scores would not be affected by high or low I.Q. Also it was felt that verbal I.Q. scores would place the low readers at a disadvantage, therefore, only non-verbal I.Q. scores were used. Information was obtained from school records. All pupils had taken the Lorge-Thorndike Intelligence Test, Form B in November, 1973. The standard deviation for this test is 16 I.Q. points, therefore, pupils whose I.Q.'s were below 84 were not included.

The combination of this and the previous restriction reduced the sample to 90 pupils. To increase the sample to the desired 96 pupils, six children whose I.Q.'s were above 116 were added. These six pupils had I.Q. scores of 117-118, allowing two points above the standard deviation. Of these six, four were high reading achievers, and two were low

reading achievers. The I.Q.'s for the final sample ranged from 84 to 118, the mean for the group being 100.71.

(c) Grade Level

Grade four students were chosen for the sample, since by that grade level they should have received instruction in syllabication skills, and should have attained some proficiency in chunking and verbal mediation skills.

(d) Sex

This was not a criteria for selection, but the sex of each subject was noted.

(e) Chronological Age

This was not a limiting factor either in the selection but each subject's age in months was obtained from the school records. The age in months of the final sample ranged from 99 to 125, and the mean age was 115.53.

(f) Hearing and Sight

A Maico Audiometer was used to screen the pupils for hearing problems. This instrument produces pure tones through a range of 125 to 8,000 cps. The frequencies at which the pupils were tested were 250, 500, 1,000 , 2,000 , 4,000 , 8,000 cps., at the 20 db. level.

Since the letters of the test words were large (2 inches), sight loss was not considered a problem, and therefore, the pupils were not screened for visual deficiencies.

The summary of the chronological age, I.Q. scores, and grade scores in reading achievement is given in Table 3.4.

TABLE 3.4

SUMMARY OF CHRONOLOGICAL AGE, I.Q. SCORES AND READING ACHIEVEMENT SCORES OF THE SAMPLE

	HRA's	LRA's	Total
No. of Subjects	48	48	96
Mean C.A. (months)	116.17	114.90	115.53
Mean I.Q. (non-verbal)	104.83	96.60	100.71
Rdg. Ach. (grade)	6.26	3.89	5.07

III. TEST INSTRUMENTS

(1) Chunking Task

The words used in this task were based upon a list of three-letter units devised by Underwood and Schulz (1960).

The words constructed were put into four formats: Ordinary, in which the spacing between the letters was proportional to that which would occur in regular typing; Syllabic, in which the spacing between syllables was five times that which would occur in regular typing; Letter, in which the spacing between each letter was five times that which would occur in regular typing; Extraordinary, in which the letters are grouped in such a way that they do not correspond to syllabic divisions of the word. Space between these units was five times that which would occur in regular typing.

The words were printed on white bristol board cards which were 22 inches by 3 inches approximately. The letters were made by the researcher, using Wrico Stencil (2 inch). The subjects were told to look at the words shown by the examiner, and when the words had been removed, to write or print what they had seen. See Appendix A and B for the words and complete directions for the administration of the task.

All words used in these tasks were nonsense words, to avoid the possibility that the children might recognize them

as sight words.

Validity. The writer depended upon content validity for this task. The purpose of this task was to measure the child's ability to group or chunk letters together when attempting to remember a word. The items were based upon three-letter pronounceable units devised by Underwood and Schulz, which they had used in a study with 181 subjects.

They had their subjects rate the pronounceability of 239 three-letter units. The units were rated between '1' and '9' on a scale where '1' indicated "easy to pronounce", and '9' indicated "hard to pronounce" sequences of letters. For the Chunking Task the researcher selected units which were rated below 4.00 on the scale.

It was obvious if a word was in Ordinary or Letter Format. The Syllabic and Extraordinary Formats were judged by graduate students, and there was total consensus on the formats.

The order of presentation of the tasks and the items of any one task were varied to prevent any particular sequence of administration from causing a bias in the scores.

The researcher used a stopwatch to insure that the subjects saw the words for one second per letter of each word.

Reliability. In order to establish reliability for the Chunking Task, a measure of split-half reliability as determined by the Kuder-Richardson Formula 20, resulted in a reliability of 0.78.

(2) Verbal Mediation Task I

The words for this task were also constructed from three letter units obtained from Underwood and Schulz, and were placed in two formats: Pronounceable and Non-pronounceable, based upon levels of pronounceability as determined by Underwood and Schulz. Directions were similar to those on the Chunking Task. The words and complete directions for the administration of the task may be found in Appendix A and B.

Validity. Content validity was also claimed for this portion of the tasks. The purpose of this task was to measure the subjects' ability to recall pronounceable and non-pronounceable sequences of letters. The degree to which sequences were pronounceable or non-pronounceable was obtained from Underwood and Schulz. These authors used a pronounceability scale which ranged from 1 to 9 ; where '1' denoted "easy to pronounce", and '9' denoted "hard to pronounce" sequences of letters. The researcher selected as Pronounceable, sequences rated below 2.50 on that scale, and Non-pronounceable, sequences rated above 5.00. Underwood and

Schulz had based the degrees of pronounceability upon information obtained from 181 subjects.

Reliability. To establish reliability for the Verbal Mediation Task I, a Kuder-Richardson Reliability Coefficient was calculated. The coefficient for the Pronounceable Items was 0.61; and the coefficient for the Non-pronounceable Items was 0.60.

(3) Verbal Mediation Task II

This task made use of two formats: Visual, in which words were presented visually only; Visual-auditory, in which the words were presented visually, and simultaneously the researcher said the word to the subjects. As with the previous tasks, the words were constructed from three-letter units obtained from Underwood and Schulz.

See the Appendix for the words and directions for the administration of the task.

Validity. The writer depended upon content validity for this task. The purpose of the task was to measure whether the pupils were able to remember words presented visually, or whether putting a verbal label on the words for them helped them to remember the word.

Once again the researcher selected three-letter units

from Underwood and Schulz to construct the words for this task. The units selected had been rated below 4.00 on the scale used by Underwood and Schulz in their study.

The researcher said each word while it was being shown to the subjects. He also used a stopwatch to insure that the subjects saw the words for one second per letter of each word.

Reliability. To establish reliability for the Verbal Mediation Task II, a Kuder-Richardson Reliability Coefficient was calculated. The coefficient for this task was 0.65.

IV. PILOT STUDY

A pilot study for the purpose of testing the materials used in this study was conducted in one school of the Edmonton Catholic School System approximately six weeks before the final data collection. Ten pupils were used, divided into high and low reading achievers, based on the results of the Gates-MacGinitie Reading Test.

The main reasons for giving the pilot study were: (a) to determine the optimal number of subjects to whom the tasks could be administered at once; (b) to determine the amount of time required to administer the tasks; (c) to determine whether the directions to be given to the pupils

were clear and concise.

The writer had planned on using six pupils per administration of each task, but found that smaller groups were easier to handle in terms of space and less confusion. It was decided that groups of two or three were optimal.

Since each task was of a short duration, time difficulties were not encountered.

The only difficulty with the directions was that the pupils often paid more attention to the researcher than to the tasks before them. The directions were altered to emphasize the task at hand.

V. COLLECTION OF DATA

The hearing screening was administered individually by the researcher. This lasted approximately five minutes per subject.

The Chunking Task was administered by the researcher to a group of two or three subjects at a sitting. An example was given to insure that the subjects understood the procedure, then the total task was administered. The total time required for the administration of this task was from five to seven minutes.

The Verbal Mediation Task I was administered in a similar manner to the previous task, and took approximately the same period of time.

The Verbal Mediation Task II, Visual Format was also administered in a similar manner, but for the Visual-auditory Format, the researcher also pronounced the word being shown. This task took from six to eight minutes to administer.

VI. SCORING THE TESTS

The Chunking Task

All tasks were scored by the examiner. One point was given for each correct response. The maximum score was eight words correct for each format.

Verbal Mediation Task I

This task was scored by the examiner. One point was given for each correct response. The results of this task yielded one score. The maximum score was four words correct for each set of items.

Verbal Mediation Task II

This task was scored by the examiner. One point was

given for each correct response. The results of this task yielded one score. The maximum score was eight words correct for each set of items.

VII. STATISTICAL TREATMENT OF THE DATA

The data were analyzed using computer programs set up by the Division of Educational Research Services of the University of Alberta. The following analyses were used.

(1) Two-Way Analysis of Variance (ANOV 25)

This analysis was used to determine whether differences existed between the two reading groups on the chunking task and the verbal mediation task. Included with ANOV 25 was the Scheffe Test to help determine the differences between the two factors mentioned above.

(2) Pearson Product Moment (DEST02)

Using this program, correlation matrices were computed for the chunking and verbal mediation tasks and the related variables for the two reading groups. For each of the correlations, t tests were carried out to determine the significance of the correlations.

Summary

In this chapter the selection of the sample, test instruments used, pilot study, collection and analysis of data were described.

The findings of the study are presented in the following chapter.

CHAPTER FOUR

ANALYSIS AND INTERPRETATION OF TEST DATA

The purpose of this chapter is to present and discuss the analysis of the test data. The statistical data are shown in table form and then analyzed and explained. The chapter is organized under the following headings:

I. Performance on the Chunking Task.

II. Performance on the Verbal Mediation Tasks

  A. Pronounceable and Non-pronounceable Items.

  B. Visual and Visual-auditory Items.

III. Related Variables.

In reporting the results of the statistical analysis a level of significance at the .05 level was accepted, as it was considered to be sufficiently rigorous for this study. Relationships which were beyond the .01 level of significance were noted.

I. PERFORMANCE ON THE CHUNKING TASK

To determine the ability of high and low reading achievers (HRA's and LRA's) to chunk or group letters and remember them, the mean scores for the four formats were analyzed. The mean scores and the standard deviations for both high and low reading achievers are presented in Table 4.1.

TABLE 4.1

MEANS AND STANDARD DEVIATIONS FOR PERFORMANCE ON THE CHUNKING TASK

Formats	HRA's		LRA's	
	Mean	S.D.	Mean	S.D.
Ordinary	5.67	1.49	4.58	2.07
Syllabic	7.07	0.95	4.08	1.83
Letter	5.58	2.29	3.75	2.18
Extraordinary	3.42	2.36	1.92	1.24

Maximum score: 8.00

The results in Table 4.1 indicate that the HRA's attained higher mean scores than the LRA's on all formats. The HRA's scored highest in the Syllabic Format, second in the Ordinary Format, third in the Letter Format, and lowest in the Extraordinary Format. The range of standard deviations followed the same pattern, with the narrowest spread in the Syllabic Format, and the widest spread in the Extraordinary Format.

For the LRA's the highest mean scores were in the Ordinary Format, and decreased through the remaining three formats, to the lowest mean in the Extraordinary Format. The pattern of standard deviations followed the same pattern as that of the HRA's for the first three formats; however, the lowest standard deviation was in the Extraordinary Format. It was noted that with such a low mean in that format, that the standard deviation could not be large. It was quite large when compared with the mean.

The scores for both the HRA's and the LRA's seemed to indicate that the scores on Ordinary and Syllabic Formats varied within reader groups, but these were both higher than the Letter Format scores, which in turn were higher than the scores of the Extraordinary Format. Dividing the words into syllables for recall purposes seemed to aid HRA's more than the LRA's. Both groups had difficulty on the Extraordinary Format. Thus it appears that it is not the size of the chunk only, but the familiarity of the chunk which determines the ease for remembering word parts. These results also lead one

to suspect that part of the familiarity aspect of chunks is related to the ease of pronounceability. Thus the HRA's had an advantage on the Syllabic Format, where there was a greater opportunity for them to use their sound-symbol association skills. That is, the words were already broken into units to which they could easily apply their pronunciation skills. They did not have the added task of dividing the words into syllables.

An analysis of variance was carried out to determine if differences between readers and formats differed significantly.

The summary of the data of Table 4.2 shows that there was a significant difference between the formats, beyond the .01 level. There was also a significant difference between the reading groups, beyond the .01 level. The table also shows that there was no significant interaction between format and reading achievement.

TABLE 4.2

ANALYSIS OF VARIANCE DATA FOR DIFFERENCES BETWEEN READING ACHIEVEMENT AND CHUNKING FORMATS

	SS	DF	MS	F	P
Formats	118.87	3	39.62	10.88	0.000006
Achievement	82.51	1	82.51	22.66	0.000009
Interaction	12.19	3	4.07	1.12	0.35

An analysis of Scheffe's Multiple Comparisons of Main Effects indicates that there were significant differences between HRA's and LRA's on all four formats of the Chunking Task (Table 4.3). The HPA's scored consistently higher than the LRA's on all tasks.

TABLE 4.3

DIFFERENCES BETWEEN HIGH AND LOW READING ACHIEVERS ON THE CHUNKING FORMATS

	Ordinary	Syllabic	Letter	Extraordinary
High and Low Readers	**	**	**	**

** Significant at .01 level

For both HRA's and LRA's there were no significant differences between any combinations of Ordinary, Syllabic and Letter Formats. However, there were significant differences between each of these formats and the Extraordinary Format (Table 4.4).

TABLE 4.4

DIFFERENCES BETWEEN CHUNKING FORMATS FOR HIGH AND LOW READING ACHIEVERS

	Ordinary	Syllabic	Letter	Extraordinary
Ordinary		NS	NS	**
Syllabic			NS	**
Letter				**
Extraordinary				

** Significant at .01 level

NS Not Significant

It seemed that the subjects in the Ordinary, Syllabic, and Letter Formats perceived and remembered the visual stimuli similarly, and were able to chunk the letters of the words in each format equally well. However, it is not possible to determine the chunk they were using in all cases. Since the LRA's scored consistently lower than the HRA's, it could be that both groups were using different strategies. For example, it could be that the HRA's were using the syllable in all cases, while the LRA's used the letter as their unit for remembering. It was also possible

that verbal mediation played a significant role in their attempts to remember. This possibility was also indicated by the fact that the results in the Extraordinary Format differed from the other three. The Extraordinary Format probably distracted the subjects from grouping the letters into natural syllabic units and interfered with the ease of pronouncing units.

II. PERFORMANCE ON VERBAL MEDIATION TASKS

A. PRONOUNCEABLE AND NON-PRONOUNCEABLE ITEMS

Data from the previous sections seem to indicate that the nature of the chunk including its ease of pronounceability rather than its size may be crucial in determining the extent to which children can remember words presented visually. In this part of the study, the size of the chunks was held constant in an effort to determine the effect of the ease of pronounceability on a child's ability to remember words presented visually.

The mean scores of the HRA's and LRA's for the Pronounceable and Non-pronounceable Items were analyzed, and with the standard deviations are presented in Table 4.5.

TABLE 4.5

MEANS AND STANDARD DEVIATIONS FOR PERFORMANCE ON VERBAL MEDIATION TASK I, PRONOUNCEABLE AND NON-PRONOUNCEABLE ITEMS

Items	HRA's		LRA's	
	Mean	S.D.	Mean	S.D.
Pronounceable	3.67	0.49	2.58	1.38
Non-pronounceable	1.42	0.95	0.25	0.45

Maximum score: 4.00

The means for the Pronounceable Items were much higher than the means for the Non-pronounceable Items, for both the HRA's and LRA's. The HRA's scored higher than the LRA's on the Pronounceable and Non-pronounceable Items. The standard deviations for the LRA's was very high in relation to their mean scores on the two sets of items, thus indicating greater variation within their test scores.

A two-way analysis of variance was undertaken to determine whether these means of the HRA's and LRA's varied significantly from each other, and also whether there were significant differences between the Pronounceable and Non-pronounceable Items for grade four readers as a group. (See Tables 4.6, 4.7, 4.8).

TABLE 4.6

ANALYSIS OF VARIANCE DATA FOR DIFFERENCES BETWEEN ACHIEVEMENT AND PRONOUNCEABLE AND NON-PRONOUNCEABLE ITEMS

	SS	DF	MS	F	P
Items	63.02	1	63.02	75.45	0.000001
Achievement	15.19	1	15.19	18.59	0.00009
Interaction	2.05	1	2.05	0.02	0.88

TABLE 4.7

DIFFERENCES BETWEEN HIGH AND LOW READING ACHIEVERS ON PRONOUNCEABLE AND NON-PRONOUNCEABLE ITEMS

	Pronounceable	Non-pronounceable
High and Low readers	**	**

** Significant at .01 level

TABLE 4.8

DIFFERENCES BETWEEN PRONOUNCEABLE AND NON-PRONOUNCEABLE ITEMS FOR HIGH AND LOW READING ACHIEVERS

	HRA's	LRA's
Items	**	**

** Significant at .01 level

There was a significant difference between the Pronounceable and Non-pronounceable Items for HRA's and LRA's, beyond the .01 level. There was no significant interaction between these items and the reading achievement groups. There was a significant difference between the HRA's and LRA's, beyond the .01 level.

The HRA's had little difficulty with the Pronounceable Items, but were often surprised and disoriented when presented with Non-Pronounceable Items, which did not have syllables to which verbal labels could easily be attached. The LRA's had somewhat the same reaction to the Non-pronounceable Items. They often expressed consternation about not being able to say the words. This observation lends further credence to the childrens' use of verbal mediation in remembering visually presented words.

It had been hypothesized that the LRA's would score similarly on both sets of items. Since their scores on the Pronounceable Items were higher, that they, as well as the HRA's were using verbal mediation to help them remember words presented visually. However, since the HRA's scored higher than the LRA's on the Non-pronounceable Items, verbal mediation alone did not appear to provide an explanation for the HRA's scores. Some kind of chunking different from that used by the LRA's must be operating for the HRA's.

B. VISUAL AND VISUAL-AUDITORY ITEMS

In order to obtain further information on the role of verbal mediation in a visual memory task, the same words were presented in a straight visual fashion and then visually, accompanied by the pronunciation of the words.

The mean scores of the HRA's and LRA's for the Visual and the Visual-auditory Items were analyzed, and these means and the standard deviations are presented in Table 4.9.

TABLE 4.9

MEANS AND STANDARD DEVIATIONS FOR PERFORMANCE ON VERBAL MEDIATION TASK II, VISUAL AND VISUAL-AUDITORY ITEMS

Items	HRA's		LRA's	
	Mean	S.D.	Mean	S.D.
Visual	4.92	2.11	3.50	1.97
Visual-auditory	5.67	1.96	3.75	1.86

Maximum score: 8.00

The scores for the Visual-auditory Items were higher

for both the HRA's and LRA's. As in the previous tasks of the study, the trend was for the HRA's to score higher than the LRA's on all tasks. The standard deviations for both groups and both sets of items were very similar, however, the deviations for the LRA's were based on lower means. There was little difference between the scores of the LRA's on the items accompanied by the pronunciation of the words. It could be that these readers tended to be confused by the simultaneous input of the two sets of stimuli.

A two-way analysis of variance was undertaken to determine whether there were differences between readers and within readers on visual items and visual-auditory items. (See Tables 4.10, 4.11, 4.12)

TABLE 4.10

ANALYSIS OF VARIANCE DATA FOR DIFFERENCES BETWEEN ACHIEVEMENT AND VISUAL AND VISUAL-AUDITORY ITEMS

	SS	DF	MS	F	P
Items	2.99	1	2.99	0.78	0.38
Achievement	33.33	1	33.33	8.64	0.005
Interaction	0.75	1	0.75	0.19	0.66

TABLE 4.11

DIFFERENCES BETWEEN HIGH AND LOW READING ACHIEVERS ON THE VISUAL AND VISUAL-AUDITORY ITEMS

	Visual	Visual-auditory
High and low readers	**	**

** Significant at .01 level

TABLE 4.12

DIFFERENCES BETWEEN VISUAL AND VISUAL-AUDITORY ITEMS FOR HIGH AND LOW READING ACHIEVERS

	HRA's	LRA's
Visual and Visual-auditory Items	NS	NS

NS Not significant

There were no significant differences between Visual and Visual-auditory Items for HRA's and LRA's. There was no significant interaction between the Items and the achievement groups. There was a significant difference between the HRA's and LRA's on the Visual and Visual-auditory Items, beyond the .01 level.

It appeared that saying the words for the subjects was of little or no help to them. In some cases it merely served as a distraction from the subjects' concentration in looking at the words; while in some other cases the subjects hardly seemed to notice the researcher saying the words for them.

III. RELATED FACTORS

The present section will consider the relationship of the Chunking Task and the Verbal Mediation Tasks to the variables of chronological age, I.Q., and reading comprehension for each of the high and low reader groups. All related factors were correlated with performances on the tasks through the computation of Pearson Product Moment correlations. Tables 4.13, 4.14, 4.15, and 4.16 summarize the information concerning correlations.

TABLE 4.13

CORRELATIONS BETWEEN CHRONOLOGICAL AGE, INTELLIGENCE QUOTIENT, READING ACHIEVEMENT, AND PERFORMANCE ON THE CHUNKING TASKS

HIGH READING ACHIEVERS

	CA	IQ	GMcG	O	S	L	E
CA		-0.27	0.15	0.01	-0.23	-0.16	0.19
IQ			0.15	-0.10	0.15	0.05	0.63*
GMcG				0.05	-0.15	0.53	0.04
O					0.16	0.12	0.58*
S						-0.12	0.23
L							0.52
E							

* Significant at .05 level

TABLE 4.14

CORRELATIONS BETWEEN CHRONOLOGICAL AGE, INTELLIGENCE QUOTIENT, READING ACHIEVEMENT, AND PERFORMANCE ON THE VERBAL MEDIATION TASKS I AND II

HIGH READING ACHIEVERS

	CA	IQ	GMcG	P	NP	V	VA
CA		-0.27	-0.13	-0.46	-0.24	-0.13	-0.03
IQ			0.15	-0.43	0.32	0.00	0.42
GMcG				0.25	0.49	0.59*	0.13
P					-0.43	0.41	-0.13
NP						0.37	-0.43
V							0.41
VA							

* Significant at .05 level

TABLE 4.15

CORRELATIONS BETWEEN CHRONOLOGICAL AGE, INTELLIGENCE QUOTIENT, READING ACHIEVEMENT, AND PERFORMANCE ON THE CHUNKING TASKS

LOW READING ACHIEVERS

	CA	IQ	GMcG	O	S	L	E
CA		-0.31	0.01	-0.67*	0.12	0.01	-0.30
IQ			0.01	-0.02	-0.08	-0.64*	0.52
GMcG				0.79**	0.56	0.06	0.42
O					0.27	0.70**	-0.15
S						-0.15	-0.08
L							0.12
E							

** Significant at .01 level

* Significant at .05 level

TABLE 4.16

CORRELATIONS BETWEEN CHRONOLOGICAL AGE, INTELLIGENCE QUOTIENT, READING ACHIEVEMENT, AND PERFORMANCE ON THE VERBAL MEDIATION TASKS I AND II

LOW READING ACHIEVERS

	CA	IQ	GMcG	P	NP	V	VA
CA		-0.31	0.01	-0.35	0.34	-0.13	0.22
IQ			0.10	-0.09	-0.03	-0.43	0.26
GMcG				0.75**	0.23	0.46	0.45
P					-0.11	0.32	-0.16
NP						0.00	0.42
V							0.03
VA							

** Significant at .01 level

Chronological age. The data concerning chronological age indicated that correlations were low in all cases for both HRA's and LRA's, with a tendency toward the negative. The only exceptions to this were for the LRA's, whose chronological age correlated significantly with performance on the Ordinary Format of the Chunking Task, at the .05 level. This correlation was negative indicating that the younger children obtained higher scores on the Chunking Task.

Intelligence Quotient. The I.Q. correlations were also very low, with only two correlation coefficients reaching the .05 level of significance. One of these occurred between I.Q. and Extraordinary Format for the HRA's. The second occured for the LRA's, where the Letter Format had a significant correlation with I. Q. at the .05 level, and that was negative. This would seem to mean that the children with lower I.Q. scores tend to use the Letter Format in remembering words. That is, they do not appear to chunk letters to the same extent as children with higher I.Q. scores.

Reading Comprehension. For the HRA's the reading comprehension scores correlated with the Visual Items of the Verbal Mediation Task II. For the LRA's there were two significant correlations, one with the Ordinary Format, the other with the Pronounceable Items of the Verbal Mediation

Task I, both were significant at the .01 level. These two tasks were very similar in that they were both made up of pronounceable items and were both equivalent in chunking requirements. Since the nature of these tasks is different from reading for comprehension, the results were not unexpected. Low reading achievers may be more word conscious, and maybe they even verbalize when reading for meaning.

Summary

The findings resulting from the interpretation of the data are summarized as follows:

1. The HRA's scored significantly higher than the LRA's on all formats of the Chunking Task.
2. The HRA's scored significantly higher than the LRA's on the Pronounceable and Non-pronounceable Items.
3. The HRA's scored significantly higher than the LRA's on the Visual and Visual-auditory Items.
4. Neither the HRA's nor the LRA's differed significantly in their scores on any combinations of the Ordinary, Syllabic, or Letter Formats of the Chunking Task.
5. Both the HRA's and LRA's scored significantly higher on each of the Ordinary, Syllabic, and Letter Formats, as opposed to the Extraordinary Format.
6. Both the HRA's and LRA's scored significantly higher on the Pronounceable Items than the Non-Pronounceable Items.
7. Neither the HRA's nor LRA's differed significantly on the

Visual and Visual-auditory Items of the Verbal Mediation Task II.

8. There were few significant correlations between the related variables of chronological age, I.Q., and reading comprehension, and the task scores. No pattern of correlation could be detected except perhaps that children with lower I.Q. scores may prefer the Letter Format in remembering words, and low reading achievers may be more word conscious than high reading achievers when reading for memory.

CHAPTER FIVE

SUMMARY, CONCLUSIONS, IMPLICATIONS, AND SUGGESTIONS FOR FURTHER RESEARCH

I. SUMMARY

The main purpose of this study was to investigate chunking abilities and verbal mediation abilities, two of the processes involved in short term memory for visual input. It has been assumed that efficient chunking of letters and syllables, and the attachment of verbal labels to sequences of letters may be related to reading success.

Chunking abilities were measured by means of a Chunking Task in which letters of words were grouped or chunked in four different ways or formats, as defined in Chapter One.

The verbal mediation abilities were measured by means of two Verbal Mediation Tasks, one of which made use of items easily pronounceable and items not easily pronounceable; the other made use of items presented visually and visually-auditorily. These tasks were also defined in Chapter One.

A sample of 96 students, 48 high reading achievers and 48 low reading achievers of average intelligence, was selected from a population of 168 students in grade four, on

the basis of scores obtained on the Gates-MacGinitie Reading Test and auditory screening.

All subjects were administered the Chunking Task, with each subject completing one of the four formats as per Table 3.1; assignment to each format was random. The sample was divided into two groups of 48 subjects and assigned to each of the two Verbal Mediation Tasks, so that any one student completed the Chunking Task and one of the two Verbal Mediation Tasks. In the Verbal Mediation Task I subjects were administered either Pronounceable or Non-pronounceable Items; in Verbal Mediation Task II the subjects were administered either Visual or Visual-auditory Items, as per Tables 3.2 and 3.3.

The findings and conclusions of the study are outlined in the following section.

II. FINDINGS AND CONCLUSIONS

The null hypotheses outlined in Chapter One are restated below and conclusions concerning their rejection or non-rejection are discussed.

Hypothesis 1

There is no significant difference in the scores obtained by the HRA's and LRA's on the Ordinary, Syllabic,

Letter, and Extraordinary Formats.

This hypothesis was rejected, for there were significant differences between the means of the HRA's and the LRA's on all formats.

Discussion

The results indicate that the HRA's short term memory for visual input is greater than that of the LRA's. This would suggest that the HRA's possess more efficient strategies for remembering words presented visually than the LRA's. It may be that the HRA's use one type of chunk, for example, the syllable, whereas the LRA's may use the letter as the unit for remembering. It also may be that the HRA's make more use of verbal mediation in helping them remember what they see. It is also possible that the LRA's may need more time to process visual information. Simon (1974) suggested that learning time is proportional to the number of chunks to be assembled. If a low reading achiever is chunking letter-by-letter, his time required to memorize something will be much greater than for a high reading achiever who learns and remembers syllable-by-syllable.

Faster decay of information may also be a problem. Alwitt (1963) found faster decay in low reading achievers. This coincides with the suggestion by Rodgers (1966) that memory traces acquired by retarded readers decays more rapidly. Alwitt also suggested that practise in reading may incidentally increase memory span by providing practise in

perceiving and remembering large chunks of material. Dechant (1970) also stated that a good reader must have developed an appropriate memory and attention span. It is possible that the low reading achievers may not have developed this type of memory span as well as the high reading achievers. They chunk but not as well as the high reading achievers.

Hypothesis 2

There is no significant difference between the scores obtained by the HRA's on the various combinations of Ordinary Format, Syllabic Format, Letter Format, and Extraordinary Format.

The results indicate that there was no significant difference between the scores on each of the Ordinary, Syllabic, and Letter Formats when any two were compared. Therefore, this part of the hypothesis was not rejected.

The scores of each of Ordinary, Syllabic, and Letter Formats were significantly higher than the scores on the Extraordinary Format. That part of the hypothesis was rejected.

Discussion

The results suggested that for the HRA's it does not matter whether a word is chunked into syllables, letters, or written in regular manner; a high reading achiever is able to see and remember the natural divisions of a word.

A word put into Extraordinary Format does not appear to look familiar to such a reader. The natural chunked units are broken. This appears to hamper the subjects' ability to verbalize, and thus recall the word.

Hypothesis 3

There is no significant difference between scores obtained by the LRA's on the various combinations of Ordinary Format, Syllabic Format, Letter Format, and Extraordinary Format.

As with the HRA's, the LRA's showed no significant differences in scores on Syllabic, Ordinary, and Letter Formats. Therefore, the part of the hypothesis that suggested these three formats would show no significant difference can not be rejected.

The performance on the Extraordinary Format indicated that there was a significant difference between that format and the other three. The part of the hypothesis referring to this finding was rejected.

Discussion

The results of this hypothesis showed the same tendency as for the HRA's in the previous hypothesis. Again it does not affect performance greatly whether the words are in Ordinary, Syllabic, or Letter Format; the low reading achievement subjects seem to be able to remember them

equally well, although all scores were lower than those obtained by the high reading achievers.

The Extraordinary Format shows up as the format with the lowest mean and it seems again that the unnatural divisions also tend to confuse the low reading achiever and interferes with his remembering of that word. If a word does not look familiar to a person in the sense that it can not be easily pronounced, it appears to be more difficult to learn and remember. The results of Hypotheses 2 and 3 indicate that the same kind of strategy for remembering appears to be operating across the Ordinary, Syllabic, and Letter Formats within reader groups. However, the fact that both groups of readers scored at different levels suggests that both groups may not be using the same strategy. The findings that the Extraordinary Format produced lower results than the other formats for both groups of readers further suggest that verbal mediation may be interacting with chunking as a strategy which grade four readers used to remember words presented visually.

Hypothesis 4

There is no significant difference in the scores obtained by the HRA's and the LRA'S on the Pronounceable Items and the Non-pronounceable Items.

The results showed that this was not so, and therefore, the hypothesis was rejected. The HRA's scored significantly

higher than the LRA's on the Pronounceable Items.

Discussion

The results from this hypothesis indicate that the HRA's are able to attach verbal labels to allowable sequences of letters more efficiently than LRA's. As with the Ordinary Format, the LRA's may require more time to process the visual information, or that the rate of decay may be faster for the low reading achiever. It was observed that several of the subjects and it may be true of the LRA's in general that they operated at a lower level of concentration. Rodgers (1966) had suggested this problem in his study of auditory memory. He stated that memory appears to be related to concentration. The greater the attention to the stimulus, it is more likely that there will be accurate recall. The researcher noticed a greater tendency among the LRA's to be distracted from the tasks and to look around the room.

Simon and Feigenbaum (1964) suggested that familiarity has major significance in ease or difficulty of learning. High reading achievers are more likely to be familiar with allowable sequences of letters than the low reading achievers and if sequences are pronounceable they tend to look more like meaningful words. It is also possible that high reading achievers possess a greater knowledge of sound-symbol association techniques.

However, the fact that the HRA's scored higher than the

LRA's on the Non-pronounceable Items suggests that factors other than use of sound-symbol association techniques account for the scores. The HRA's appear to use a different strategy than the LRA's in remembering these words and may possibly be chunking these words in a different manner than the LRA's.

Hypothesis 5

There is no significant difference between the scores obtained by the HRA's on the Pronounceable and Non-pronounceable Items.

This hypothesis was rejected. The HRA's scored significantly higher on the Pronounceable Items than on the Non-pronounceable Items.

Discussion

This was as expected, that the HRA's would score higher on the Pronounceable Items. When a word has familiar sequences of letters that resemble allowable sequences of letters of the English language, it is much easier to attach a verbal label and, therefore, easier to remember. For the Non-pronounceable Items it is almost impossible to attach a verbal label, so the reader has difficulty in remembering it.

The results of this hypothesis may be compared with the results of Hypothesis 1. For the Ordinary Format of the

Chunking Task and the Pronounceable Items of the Verbal Mediation Task I, the requirements for memorizing the words appear to be similar. The idea of familiarity seems to play an important part in the ability to remember sequences of letters. If sequences of letters resemble sequences common to the English language, then the subjects seem to find it easier to recognize and attach a verbal label to such sequences.

Hypothesis 6

There is no significant difference between the scores obtained by the LRA's on the Pronounceable and Non-pronounceable Items.

This hypothesis was rejected. There were significant differences in performance on the Pronounceable and Non-pronounceable Items. The LRA's scored much higher on the Pronounceable Items.

Discussion

It had been assumed that the LRA's would not be able to verbalize well, but would remember the visual images of both pronounceable and non-pronounceable words letter-by-letter. Therefore it would not have mattered whether the words resembled allowable sequences of letters of the English language. But that was not so. The LRA's were able to verbalize the Pronounceable Items to some extent and as a result scored higher on them than on the Non-pronounceable.

This finding lends further support to the role of verbal mediation in visual memory processing.

Hypothesis 7

There is no significant difference in the scores obtained by HRA's on the Visual Items and the Visual-auditory Items.

The scores were higher for the Visual-auditory Items, but not enough to be significant, therefore, this hypothesis is not rejected.

Discussion

The additional mode (auditory) of input for the Visual-auditory Items seems to have made little difference to the scores of the HRA's. It would appear that these subjects concentrated on seeing the words on the cards and paid little attention to hearing the sounds of them. The visual was sufficient input for them, for that is what they have to do in normal reading situations; they do not have auditory aids. They have come to learn to verbalize the words they see without outside help.

Hypothesis 8

There is no significant difference between the scores obtained by the LRA's on the Visual Items and the Visual-auditory Items.

The LRA's scored almost the same on both the Visual and Visual-auditory Items, thus the hypothesis is not rejected.

Discussion

It was assumed that the Visual-auditory presentation would aid the LRA's by giving them an extra source of input to put verbal labels on the words for them. This was not the case, for their scores did not differ significantly over the two sets of items. The researcher noticed that the tendency of the LRA'S was to look at him as he was saying the word rather than at the card with the word on it. This happened in spite of the researcher advising the subjects to concentrate on the cards. This also occured with the HRA's but to a lesser extent. Saying words simultaneously with visual presentation is not sufficient to build up an effective strategy for remembering.

On the other hand it may have been confusing to some subjects to receive the bisensory input at once, and this may have hindered the subjects' performance. In several other cases the auditory input did not appear to be noticed at all.

III. LIMITATIONS

During the study the following limitations became evident and which may limit the generalizability of the

findings.

(1) The concern raised at the beginning of the study that verbal mediation may interact with chunking was borne out by the results. The Chunking Task did not exclude children from using their verbal mediation ability.

(2) The I.Q. scores of the high and low reader groups differed by a mean of eight points. Consequently the I.Q. factor may be an influencing factor in the results obtained.

IV. IMPLICATIONS

The results of this study suggest that the high reading achievers and the low reading achievers differed significantly in their ability to chunk letters or syllables when trying to remember them. The processes that the high reading achievers and the low reading achievers used appeared to be similar, but since the low reading achievers scored lower than the high reading achievers, it is evident that the two groups are operating on different levels of the same skills. However, it also may be that different chunking strategies were being used by the different groups of readers. Possibly the low reading achievers did not have sufficient knowledge of the sound-symbol relationships to verbalize the stimuli as well as the high reading achievers. To improve low reading achiever performance in chunking and verbalizing letters and words it may be advisable to improve their knowledge of sound-symbol relationships by providing

them with techniques for using word attack skills. It is suggested that in teaching word attack skills that the student be keyed to look for the syllables of the words, followed by the sound of the word to strengthen the association he makes between the symbols and their sounds.

It appears that adding a verbal label simultaneously with a visual presentation seems to be of little value to subjects when trying to remember the words presented, at least in a test situation such as in this study. This could be kept in mind in a teaching situation where the teacher could sequence the sensory inputs, in order that the child might have an opportunity to study the word visually before hearing its sound. Otherwise the child may become confused by receiving two sensory inputs at once.

In teaching words which children must be able to recognize minutes later when reading a story (as in the typical basal reader lesson), it may be advisable to have either the children in unison, or several children individually, pronounce each of the words before moving on to the story phase of the lesson.

V. SUGGESTIONS FOR FURTHER RESEARCH

The findings and conclusions of the study produced the following suggestions for further research.

I. A study might be undertaken in which the method of

initial teaching of reading is taken into account to determine whether teaching methods affect the ability of children to attach verbal labels to words.

2. A follow-up study could be done to determine whether the same results hold true for the same sample of children at a later stage in their development.

3. A cross-section study might be done at several grade levels to determine whether chunking and verbal mediation abilities are similar at different age and grade levels.

4. A teaching study might be undertaken to see whether the low reading achievers could develop more effective strategies in remembering words.

5. Another problem for research might involve the determination of the rate of decay of information from the sensory store and its effects on reading achievement.

6. A study might be undertaken which would investigate the relationship of verbal mediation and techniques used for word identification.

VI. CONCLUDING STATEMENT

This study attempted to measure the chunking and verbal mediation abilities of a group of high reading achievers and low reading achievers at the grade four level, and to determine the relationship of these abilities to reading achievement.

Findings showed that the high reading achievers scored higher than the low reading achievers on all tasks. The high reading achievers and low reading achievers did not differ on the nature of their processing of the Chunking Task or the Verbal Mediation Tasks. Both reader groups appeared to process the stimuli similarly, but at different levels. This was evident from the parallel scores made by the high reading achievers and low reading achievers on all tasks.

Visual presentation supplemented simultaneously with auditory presentation did not seem to be of much help in remembering words for the high reading achievers and the low reading achievers.

There were few significant correlations between the Chunking Task and Verbal Mediation Tasks and the related variables of chronological age, I.Q., and Gates-MacGinitie Reading Test scores.

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APPENDIX A

WORDS CONSTRUCTED FOR THE CHUNKING TASK AND THE VERBAL MEDIATION TASKS

Chunking Task

Ordinary Format

balpuf

nopgaw

dapsayite

facwisman

catroc

maksom

pidratous

verestdal

Syllabic Format

bal	puf	
nop	gaw	
dap	say	ite
fac	wis	man
cat	roc	
mak	som	
pid	rat	ous
ver	est	dal

Letter Format

b a l p u f

n o p g a w

d a p s a y i t e

f a c w i s m a n

c a t r o c

m a k s o m

p i d r a t o u s

v e r e s t d a l

Extraordinary Format

b alp uf

n opg aw

d aps ayi te

f acw ism an

c atr oc

m aks om

p idr ato us

v ere std al

Verbal Mediation Task I

Pronounceable Items

andmul

artfem

kimbadsub

fibwasmop

Non-pronounceable Items

mptyoqidw

cwbndftly

xikcfl

rajhfg

Verbal Mediation Task II

Visual and Visual-auditory Items (same for both)

gelpus

hobwam

tozbot

tiswambad

kimvizdok

kixdir

wasmefdir

relzamvas

APPENDIX B

INSTRUCTIONS AND PROCEDURES FOLLOWED FOR THE CHUNKING TASK AND THE VERBAL MEDIATION TASKS

INSTRUCTIONS AND PROCEDURES FOLLOWED FOR THE CHUNKING TASK AND THE VERBAL MEDIATION TASKS

When the subjects arrived at the testing session the researcher introduces himself and asks the names of the subjects and says: "I have some things for you to do. It will take only about five minutes for you to do them. Listen carefully, I'm going to show you some cards with words printed on them. These words are nonsense words, that is, they don't mean anything. After I remove the card write down the word which you have seen. I will show you an example first."

After the example questions were answered if someone had not understood clearly.

For formats in which there was unusual spacing between the letters the following instructions were given: "Note that in some places the letters are separated; you may write them in the normal manner".

This pattern was followed for the Chunking Task, the Verbal Mediation Task I, and the Visual Items of the Verbal Mediation Task II. For the Visual-auditory Items of the Verbal Mediation Task II an additional instruction was given: "While you are looking at the word I will say it for you. Be sure to look at the word and not at me".

The subjects were shown one card at a time with a word printed on it. The length of time that a word was exposed

was one second per letter. When it was removed the subjects were to write the word they had seen on forms provided by the researcher.